G-37-X51

Final Report for Period: 07/1999 - 06/2003
Submitted on: 10/09/2003
Principal Investigator: Thomas, Robin .
Award ID: 9970514
Organization: GA Tech Res Corp - GIT
Title:
Research in Structural Graph Theory

Project Participants

Senior Personnel

Name: Thomas, Robin
Worked for more than 160 Hours: Yes
Contribution to Project:

Post-doc

Graduate Student

Name: Hegde, Rajneesh
Worked for more than 160 Hours: Yes
Contribution to Project:

Undergraduate Student

Technician, Programmer

Other Participant

Research Experience for Undergraduates

Organizational Partners

Other Collaborators or Contacts

Activities and Findings

Research and Education Activities:
During the first year funds were provided for the support of graduate students only. The students supported were Jan Thomson and Rajneesh Hegde. Ms. Thomson worked on (a special case of) Tutte's 4-flow conjecture. She defended her dissertation and obtained her doctorate in 2000.

Mr. Hegde worked on a more efficient implementation of the even directed cycle algorithm found by Robertson, Seymour and the PI. To obtain a linear time algorithm he needed to generalize a well-known (and difficult) triconnectivity algorithm of Hopcroft and Tarjan. He currently works on a conjecture of Jorgensen about 6-connected graphs with no K6 minors.

Mr. Christopher Carl Heckman (a PhD student of the PI, not supported from this grant) defended his dissertation entitled 'Independent sets

in bounded degree graphs' and obtained his doctorate, also in 2000.

Since January 2000 the PI devoted most of his energy to the Strong Perfect Graph Conjecture (SPGC) of Berge from 1960. A graph is perfect if for every induced subgraph, the chromatic number is equal to the maximum size of a complete subgraph. The SPGC asserts that a graph is perfect if and only if it has no induced subgraph isomorphic to an odd cycle of length at least five, or the complement of such a cycle. With Chudnovsky, Robertson and Seymour the PI obtained a proof.

Findings:

The main result obtained was a proof of the Strong Perfect Graph Conjecture of Berge from 1960 stating that a graph is perfect if and only if it has no induced subgraph isomorphic to an odd cycle of length five or more, or the complement of such an odd cycle.

Training and Development:

Students were trained in carrying out original mathematics research.

Outreach Activities:

I have given numerous lectures about my work, including a number of public lectures and lectures attended by undergraduates and some by high school students.

Journal Publications

R. Thomas and R. Diestel, "Excluding a countable clique", J. Combin. Theory Ser. B, p. 41-67, vol. 76, (1999). Published

R. Thomas, M. Juvan and B. Mohar, "List edge-colorings of series-parallel graphs", Electron. J. Combin., p. R42, vol. 6, (1999). Published

R. Thomas (eds. J. D. Lamb and D. A. Preece), "Recent excluded minor theorems for graphs", Surveys in Combinatorics, Cambridge University Press
, p. Chap. 7, vol. , (1999). Published

R. Thomas and B. Reed, "Clique minors in graphs and their complements", J. Combin. Theory Ser. B, p. 81-85, vol. 78, (2000). Published

R. Thomas, N. Robertson and P. D. Seymour, "Permanents, Pfaffian orientations, and even directed circuits", Ann. Math., p. 929-975, vol. 150, (1999). Published

R. Thomas and C. C. Heckman, "A new proof of the independence ratio of triangle-free cubic graph", Discrete Math., p. 233, vol. 233, (1999). Published

R. Thomas and J. Thomson, "Excluding minors in nonplanar graphs of girth at least five", Combinat. Prob. Comput., p. 573, vol. 9, (2000). Published

T. Johnson, N. Robertson, P. D. Seymour and R. Thomas, "Directed tree-width", J. Combinat. Theory Ser. B, p. 138, vol. 82, (2001). Published

N. Alon, D. Mubayi and R. Thomas, "Large induced forests in sparse graphs", J. Graph Theory, p. 113, vol. 38, (2001). Published

T. Johnson and R. Thomas, "Generating internally 4-connected graphs", J. Combin. Theory Ser. B, p. 21, vol. 85, (2002). Published

Books or Other One-time Publications

Web/Internet Site

URL(s):
http://www.math.gatech.edu/~thomas/EVENC/
Description:

Other Specific Products

Contributions

Contributions within Discipline:
My collaborators and I have proved the Strong Perfect Graph Conjecture of Berge from 1960, a major open problem in graph theory.

Contributions to Other Disciplines:
Perfect graphs are of interest in other disciplines such as operations research and theoretical computer science, because they are related to many diverse concepts and theories (communication theory, polyhedral combinatorics, semi-definite programming, radio channel assignment, sorting, municipal routing, stable matchings, geometric algorithms)

Contributions to Human Resource Development:
Training graduate students

Contributions to Resources for Research and Education:

Contributions Beyond Science and Engineering:

Categories for which nothing is reported:

Organizational Partners
Any Book
Any Product
Contributions: To Any Resources for Research and Education
Contributions: To Any Beyond Science and Engineering